by relating his fresh experiments on their powers of communication. Among others a dead blue-bottle fly was pinned down, and after vain efforts at removal the selected ant hied home, and emerged with friends who slowly, and evidently incredulously, followed their guide. The latter starting off at a great pace distanced them, and they returned, again, however, to be informed, come out and at length be coaxed to the prey. In the several experiments with different species of ants and under varied circumstances, these seem to indicate the possession by ants of something approaching language. It is impossible to doubt that the friends were brought out by the first ant, and as she returned empty handed to the nest the others cannot have been induced to follow merely by observing her proceedings. Hence the conclusion that they possess the power of requesting their friends to come and help them. For other experiments testing the recognition of relations, although the old ants had absolutely never seen the young ones until the moment, some days after arriving at maturity, they were introduced into the nest, yet in all cases they were undoubtedly recognised as belonging to the community. It would seem, therefore, to be established that the recognition of ants is not personal and individual, and that their harmony is not due to the fact that each ant is acquainted with every other member of the community. It would further appear from the fact that they recognise their friends even when intoxicated, and that they know the young born in their own nest, even when they have been brought out of the chrysalis by strangers, indicating, therefore, that the recognition is not effected by means of any sign or password. With regard to workers breeding, the additional evidence tends to confirm previously-advanced views, that when workers lay eggs males are always the issue of these. Without entering into details of instances it may broadly be affirmed that in the queenless nests males have been produced, and in not a single case has a worker laid eggs which have produced a female, either a queen or a worker. On the contrary, in nests possessing a queen, workers have been abundantly produced. The inference to these curious physiological facts leads to the presumption that, as in the case of bees, so also in ants, some special food is required to develop the female embryo into a queen. In Sir John's nests, while from accidents and other causes many ants are lost during the summer months, in winter, nevertheless, there are few deaths. As to the age attained, specimens of *Formica fusca* and *F. sanguinea*, still lively, are now four and others five years old at least. The behaviour to strange queens often results in their being ruthlessly killed; yet as communities are known to have existed for years, queens must occasionally have been adopted. With the view of trying how far dislike and passion might be assuaged by a formal temporary acquaintance a queen of *F. fusca* was introduced into a queenless nest, but protected by a wire cage, and after some days the latter removed, but the queen was at once attacked. Mr. McCook, nevertheless, relates an instance of a fertile queen of *Cremastogaster lineolata* having been adopted by a colony of the same species.

Such difference in conduct, Sir John suggests, may be due to his own ants having been living in a republic; for it is affirmed that bees long without a queen are strongly averse to adopt or accept another. Furthermore, if a few ants from a strange nest are put along with a queen they do not attack her, and if other ants are by degrees added the throne is ultimately secured. In pursuance of experiments to test the sense of direction, some ants were trained to go for their food over a wooden bridge made up of segments. Having got accustomed to the way, afterwards when an ant was in the act of crossing, a segment was suddenly reversed in direction, evidently to the ant's discomfiture; she then either turned round, or, after traversing the bridge, would return. When, however, similar pieces of wood were placed between nest and food, and the ant at the middle piece, those at the ends being transposed, the ant was not disconcerted. In other instances a circular paper disk was placed on a paper bridge, and when the ant was on the disk this was revolved, but the ant turned round with the paper. A hat-box with holes of entrance and exit pierced at opposite sides was planted across the line to the food; when the ant had entered and the box turned round, the ant likewise wheeled about, evidently retaining her sense of direction. Again, with the insect *en route*, when the disk or box with the ant within was merely shifted to the opposite side of the food without being turned round, the ant did not turn round, but continued in what ought to have been the direction to the food, and evidently was surprised at the result on arrival at the spot where the food had previously been. To ascertain whether ants make sounds audible to one another, the use of the telephone was resorted to, but the results were negative. These experiments may not be conclusive, for the plate of the telephone may be too stiff to be set in vibration by any sounds which the ants produced. As opposed to the opinion expressed by M. Dewitz, Sir J. Lubbock regards the ancestral ant as having been aculeate, and that the rudimentary condition of the sting in *Formica* is due to atrophy, perhaps attributable to disuse. A ground plan of the nest of *Lasius niger* is now given by Sir John, which exhibits an intricate, narrow, and winding entrance-passage; the main nest cavity is further supported by pillars, and here and there by islands; protected recesses obtain, evidently strategical retreats in times of danger. Studying the relations and treatment of the aphides, or plant-lice of the ants, Sir John clearly demonstrates that not only are the aphides kept and protected in the ants' nests, but the eggs of *Aphis* laid outside on the leaf-stalks of its food-plant in October, when exposed to risks of weather, are carefully brought by the ants into their nests, and afterwards tended by them during the long winter months until March, when the young ones are again brought out and placed on the young vegetable shoots. This proves prudential motives, for though our native ants may not lay up such great supplies of winter stores of food as do some of those found abroad, they thus nevertheless take the means to enable them to procure food during the following summer. The fact of European ants not generally laying up abundant stores may be due to the nature of their food. Insects and small animals form portions of their food, and these cannot always be kept fresh. They may also not have learnt the art of building vessels for their honey, probably because their young are not kept in cells like those of the honey bee, and their pupæ do not construct cocoons like those of the humble bee. Relatively to their size our English ants nevertheless store proportionally; for if the little brown garden ant be watched milking their aphides, a marked abdominal distension is observable. The paper concludes by the history and technical description of a new species of Australian honey ant. This corroborates Westmael's strange account of the Mexican species; certain individual ants being told off as receptacles for food, in short they become literally animated honey pots.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE committee of management of the Royal Agricultural College, Cirencester, have just established two scholarships of 25*l.* and 10*l.* respectively, to be open to all students of the college, and to be awarded three times every year in accordance with the results of the sessional examinations. The first award will take place after the Christmas examination of the present year. The vellum certificates and book prizes, and the gold medals, will be continued as heretofore.

THE first session of the representative Conseil Superieure de l'Instruction Publique of France was closed on June 17, by an address pronounced by M. Jules Ferry. The result of the deliberations has been to raise the standard of *Baccalaureat*, the first step in French classical honours; the time allotted to Greek and Latin in the course of studies has been curtailed at the expense of themes and versification, and allotted either to science or to living languages. The work of the next session will be to organise the scientific instruction. Sharp discussions are expected between the delegates who wish to organise a special course of instruction for sciences, and those who stick to the old scheme of making the preparation for the Government schools a supplement to classical instruction.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, No. 5.—On tones generated by a limited number of impulses, by W. Kohlrausch.—On torsion, by E. Warburg.—On stationary vibrations of a heavy fluid, by G. Kirchhoff. On the propagation of electricity by current water, and allied phenomena (continued), by E. Dorn.—On the new relation discovered by Dr. Kerr between light and electricity, by W. C. Röntgen.—On some new researches on the mean length of path of molecules, by R. Clausius.—Researches on heat-conduction in liquids, by H. F. Weber.—Researches on the height of the atmosphere and the constitution of gaseous celestial bodies (continued), by A. Ritter.—On ultra-violet rays (con-

tinued), by J. L. Schönn.—On a new simple condensation-hygrometer, by A. Matem.—On a general proposition of Herr Clausius in reference to electric induction, by G. J. Legebeke.—On an optical illusion in looking at geometrical figures, by W. Holtz.—Reflection and refraction of light on spherical surfaces, supposing finite angle of incidence, by F. Lippich.

American Journal of Science, May.—Outlet of Lake Bonneville, by G. K. Gilbert.—Chemical and geological relations of the atmosphere, by T. Sterry Hunt.—Archæan rocks of Wahsatch Mountains, by A. Geikie.—Apatites containing manganese, by S. L. Penfield.—New meteorite in Cleberne co., Alabama, by W. E. Hidden.—On the recent formation of quartz and on silicification in California, by T. S. Hunt.—The Uranometria argentina, by H. A. Newton.—The Ivanpah, California, meteoric iron, by C. U. Shephard.—The atomic weight of antimony (preliminary notice of additional experiments), by J. P. Cooke.—Daubrée's experimental geology, by J. Lawrence Smith.—Bastnäsite and Tysonite from Colorado, by O. D. Allen and W. J. Comstock.—On argento-antimonious tartrate (silver emetic), by J. P. Cooke.—The sternum in Dinosaurian reptiles, by O. C. Marsh.—On the southern comet of February, 1880, by B. A. Gould.

Proceedings of the Boston Society of Natural History, vol. xx., part 3 (published April).—Dr. Sam. Kneeland, the mineralised phosphatic guanos of the equatorial Pacific Islands; on the frozen well at Decorah, Iowa.—Prof. Brewer, additional notes on his lists of New England birds; catalogue of humming-birds in the Society's collection (only commencement).—Prof. Shaler, on the submarine coast shelf.—Dr. Wadsworth, on danalite from the iron-mine, Bartlett, N.H.; on picrolite from a serpentine quarry in Florida, with analysis by W. H. Melville.—J. H. Huntington, on the iron ore of Bartlett, N.H.—Dr. Fewkes, on *Rhizophysa filiformis*, with a plate; on the tubes in the larger nectocalyx of *Abyla pentagona*, with a plate.—Prof. E. Morse, on the antiquities of Japan.—F. W. Putnam, on chambered mounds in Missouri; on some explorations in Tennessee, with remarks on some bones of N.E. Indians; on the ornamentation of some aboriginal American pottery.—Dr. Hagen, on a new species of Simulium with a remarkable Nympha-case—W. O. Crosby, on evidences of compression in the rocks of the Boston basin.—Dr. W. K. Brookes, development of the digestive tract in molluscs.—S. H. Scudder, probable age of Haulover Beach, Nantucket Harbour.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 27.—"On the Relation of the Urea to the Total Nitrogen of the Urine in Disease," by W. J. Russell, Ph.D., F.R.S., and Samuel West, M.B., Oxon.

In the valuable series of papers upon the excretion of urea, communicated by Prof. Parkes to the Royal Society, he showed that in health 90 per cent. of the nitrogen in the urine was eliminated in the form of urea. It seemed to us of considerable interest and importance to ascertain whether in disease this statement still held good, or whether, as indeed seemed probable, under altered conditions, nitrogen might not be excreted in some other form. With the view of determining this point, the following experiments were undertaken.

The cases upon which the observations were made fall into two groups—the first, a series taken at random from the hospital, the patients suffering from various diseases, and being under various conditions as regarded diet, muscular exertion, &c. In the second series, the patients were healthy, and placed under conditions as far as possible constant, the amount of diet being fixed, and the patients at absolute rest.

The first series, consisting of twenty-three observations, falls into several small groups. The relation of the urea-nitrogen to the total nitrogen was, in all cases, calculated out in percentage amounts (the total nitrogen being taken as 100), and the mean of each group of observations given.

The first group consists of six cases of pneumonia, and in these the urea-nitrogen represents 90 per cent. of the total nitrogen.

The second, of two cases of jaundice, with two determinations in each. The mean of the first giving 85·7 per cent.; of the second 90·2 per cent.

The third, of two cases of albuminuria, in which the mean is 86 per cent. In these observations the albumen was previously precipitated and removed. In a third case the determination was made without previously removing the albumen. In this latter, the percentage was 63·6.

The fourth group consists of a collection of cases of various kinds. One of pyæmia, one of typhoid fever, rheumatic fever, acute dysentery, pleurisy, hepatic abscess, and leucocythæmia, two of erysipelas, and two of diabetes, making eleven in all. The mean percentage of them all is 93·8.

The lowest percentage in this first series is found in the cases of albuminuria and of jaundice, a fact of interest as bearing upon the place of production of urea.

The second series consists of eighteen determinations made upon three cases, in which the diet was fixed and the patient in a condition of absolute rest.

These give a mean of 90·1 per cent. The mean of all the cases in the two series is 89·3, or, if the cases of albuminuria and jaundice be excluded, 91·3 per cent., and this agrees almost exactly with the results of Prof. Parkes' experiments, in which the mean arrived at is 91 per cent.

We may therefore assume that the urea-nitrogen may be taken as the measure of the total nitrogen, and that this may be approximately determined by adding 10 per cent. to the amount of urea-nitrogen.

This is, however, only true if the mean of a large number of observations be taken, for there is no fixed relation between, on the one hand, the amount of the urine and the amount of the solids in it, or on the other, between the amount of the various solids *inter se*.

The result, then, of our observations is to prove that the chemistry of the urine remains essentially the same in disease as in health, and that the generalisation of Prof. Parkes is true in either case. The urea may therefore be safely regarded as the measure of the total nitrogen, and as forming 90 per cent. of it.

"On the amount of Nitrogen excreted by Man at rest," by Samuel West, M.B. Oxon, and W. J. Russell, Ph.D., F.R.S.

The three patients, the subjects of this investigation, were all placed under the conditions of the most absolute rest, not being allowed to sit up in bed, or even indeed to feed themselves. Their diet was reduced till it was found that their health was suffering, and then increased until a condition was reached, which may be called one of "clinical equilibrium," when the health, so far as could be determined clinically, was perfect.

The patients were all suffering from the same affection, viz., aneurism, a disease which produces mechanical rather than constitutional symptoms, and in these cases, so long as the treatment was carried on, produced no symptoms at all, so that for all practical purposes the patients may be regarded as healthy men.

The condition of clinical equilibrium being reached, the amount of nitrogen in the food was determined by direct analysis.

In two of the cases the diet consisted of 10 ozs. of solids and 10 ozs. of liquids.

By calculation from Parkes' tables, this should yield 6·3 grms. of nitrogen. Analysis gave a somewhat higher number: in the first determination 7·07, and in the second 6·95.

In the third case the diet was 8 ozs. of solids and 8 ozs. of liquids, distributed in the same proportion. This by calculation from the preceding analysis should give about 5·6 grms. of nitrogen.

Comparing now the amount of nitrogen ingested in the food with the amount obtained from the urine, we find:—

	Nitrogen ingested.		Nitrogen in urine.
Case I.	7·0	...	8·6
,, II.	7·0	...	8·64
,, III.	5·6	...	6·4

In all the cases the amount in the urine is in slight excess of that in the food, so that we may fairly regard all the nitrogen here obtained as representing tissue waste, for there was no surplus in the food to increase the amount in the urine.

We obtain as the mean of these three cases $\frac{23·64}{3} = 7·87$, or approximately 8 grms., which we therefore are justified in regarding as the minimum amount of nitrogen a healthy adult man excretes per diem. This is equivalent to 17 grms., or 260 grains of urea.

It is interesting to compare with these observations the results obtained by the other methods of the investigation above referred to.

Ranke repeated upon man the experiments which Bischoff and